Name :	Ms.Neerja Doshi
UID	2021300029
Div	SE CE DIV A – BATCH B
Experiment No. 7: Backtracking strategy – N-Queen problem	

AIM :	Backtracking strategy – N-Queen problem
THEORY :	1. The N Queen is the problem of placing N chess queens on an N×N chessboard so that no two queens attack each other **2. ALGORITHM :** (a) Initialize an empty chessboard of size NxN. (b) Start with the leftmost column and place a queen in the first row of that column. (c) Move to the next column and place a queen in the first row of that column. (d) Repeat step 3 until either all N queens have been placed or it is impossible to place a queen in the current column without violating the rules of the problem. (e) If all N queens have been placed, print the solution. (f) If it is not possible to place a queen in the current column without violating the rules of the problem, backtrack to the previous column. (g) Remove the queen from the previous column and move it down one row. (h) Repeat steps 4-7 until all possible configurations have been tried.

```
function solveNQueens(board, col, n):
  if col >= n:
    print board
    return true
  for row from 0 to n-1:
    if isSafe(board, row, col, n):
      board[row][col] = 1
      if solveNQueens(board, col+1, n):
        return true
      board[row][col] = 0
  return false

function isSafe(board, row, col, n):
  for i from 0 to col-1:
    if board[row][i] == 1:
```

```
    return false
  for i,j from row-1, col-1 to 0, 0 by -1:
    if board[i][j] == 1:
      return false
  for i,j from row+1, col-1 to n-1, 0 by 1, -1:
    if board[i][j] == 1:
      return false
  return true

board = empty NxN chessboard
solveNQueens(board, 0, N)
```

3. Time Complexity :

1. **Time Complexity:** O(N!) where N is number of queens , and also the the number of rows and columns in given board .

CODE:

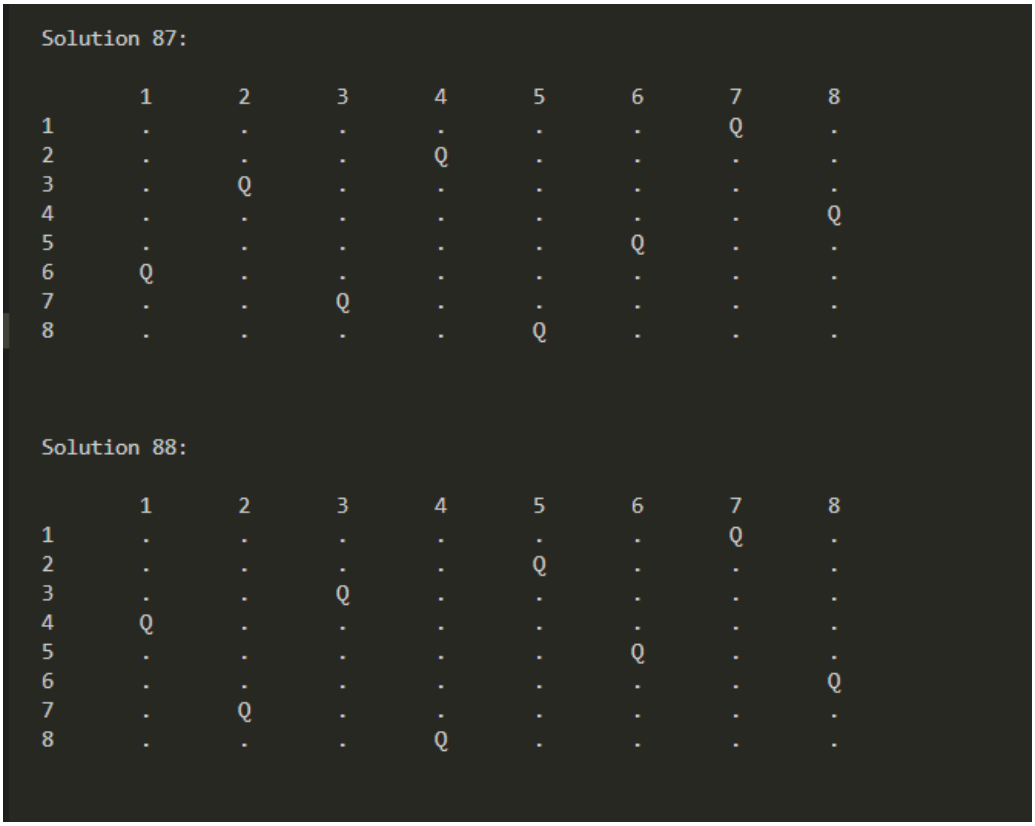
```c
#include <stdio.h>
#include <math.h>
#include <stdlib.h>

//board index --> row no , borad[index] --> col no at which queen is placed
int board[20], count;
int main()
{
    int n, i, j;
    void queen(int row, int n);

    printf(" - N Queens Problem Using Backtracking -");
    printf("\n\nEnter number of Queens:");
    scanf("%d", &n);
    queen(1, n);
    return 0;
}

// function for printing the solution
void print(int n)
{
    int i, j;
    printf("\n\nSolution %d:\n\n", ++count);

    for (i = 1; i <= n; ++i){
    //column indexes
        printf("\t%d", i);
```

```
    }

    for (i = 1; i <= n; ++i)
    {
        //row indexes
        printf("\n%d\t", i);
        for (j = 1; j <= n; ++j) // for nxn board
        {
            if (board[i] == j)
            // queen at i,j position
                printf("Q\t");
            else
                printf(".\t"); // empty slot
        }
    }

    printf("\n\n");
}

/*funtion to check conflicts
If no conflict for desired postion returns 1 otherwise returns 0*/
int place(int row, int column)
{
    int i;
    for (i = 1; i <= row - 1; ++i)
    {
        // checking column cond.
        // if board[current_row] has value == current col .. not
allowed
        if (board[i] == column)
            return 0;

        // check diagonal
        else if (abs(board[i] - column) == abs(i - row))
            return 0;
    }

    return 1; // all cond met
}

// function --> if postion locked .. place queen .. move to next
void queen(int row, int n)
{
    int column;
    for (column = 1; column <= n; ++column)

    {
        // printf("(%d-%d)\n" , row , column);
        if (place(row, column))
        {
```

```
            // printf("yes\n");

            // if all condition met .. place queen
            board[row] = column;
            // all rows handled ... print final board config
            if (row == n)
                print(n);
            else
                // one row done .. move to next
                queen(row + 1, n);
        }
    }
}
```

OUTPUT :

```
Solution 91:

      1     2     3     4     5     6     7     8
1     .     .     .     .     .     .     .     Q
2     .     .     Q     .     .     .     .     .
3     Q     .     .     .     .     .     .     .
4     .     .     .     .     .     Q     .     .
5     .     Q     .     .     .     .     .     .
6     .     .     .     .     Q     .     .     .
7     .     .     .     .     .     .     Q     .
8     .     .     .     Q     .     .     .     .


Solution 92:

      1     2     3     4     5     6     7     8
1     .     .     .     .     .     .     .     Q
2     .     .     .     Q     .     .     .     .
3     Q     .     .     .     .     .     .     .
4     .     .     Q     .     .     .     .     .
5     .     .     .     .     .     Q     .     .
6     .     Q     .     .     .     .     .     .
7     .     .     .     .     .     .     Q     .
8     .     .     .     .     Q     .     .     .
                                                 _
Solution 89:

      1     2     3     4     5     6     7     8
1     .     .     .     .     .     .     .     Q
2     .     Q     .     .     .     .     .     .
3     .     .     .     Q     .     .     .     .
4     Q     .     .     .     .     .     .     .
5     .     .     .     .     .     .     Q     .
6     .     .     .     .     Q     .     .     .
7     .     .     Q     .     .     .     .     .
8     .     .     .     .     .     Q     .     .


Solution 90:

      1     2     3     4     5     6     7     8
1     .     .     .     .     .     .     .     Q
2     .     Q     .     .     .     .     .     .
3     .     .     .     .     Q     .     .     .
4     .     .     Q     .     .     .     .     .
5     Q     .     .     .     .     .     .     .
6     .     .     .     .     .     .     Q     .
7     .     .     .     Q     .     .     .     .
8     .     .     .     .     .     Q     .     .
```



CONCLUSION :	By performing the above experiment , i have successfully understood to perform Backtracking by solving N – Queen Problem by Taking N = 8 . A total of 92 solution were seen out of which , 6 are shown above.